PRACTICE BREAKEVEN ANALYSIS PROBLEMS

The following practice problems are based on the following scenario.
An opportunity exists to develop a water source (spring) and improve grazing distribution. This will allow the harvest of 30 AUM's in an area where only 10 are harvested currently.

Total Cost x Amortization Factor = Value of the Change in Yield

TIME
What is the period of capital recovery or minimum life expectancy for the proposal if the capital cost is $2,000, and 8% interest rate is used, and the value of the change in AUM's produced is $230 per year.

SOLUTION: Breakeven Time is approximately 15 years

PRICE (COST)
How much can the cooperator afford to spend (capital cost) for the stock water development if the life is 20 years, the interest rate is 12% and an AUM is valued at $7.00?

SOLUTION: Breakeven Price is $1,045.72

VALUE (YIELD)
What must an AUM be worth to break even when capital cost is $1,400, evaluation is 20 years, and benefits are discounted at 11%?

SOLUTION: Breakeven Value is $8.79

INTEREST RATE
What is the breakeven interest rate or internal rate of return when capital cost is $1,500, effects are evaluated over a 20 year time period and the value of the change in AUM's produced is $210?

SOLUTION: Breakeven Interest Rate is approximately 12%

For more information on Breakeven Analysis, contact you local NRCS office.

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Envelope Economics

BREAKEVEN ANALYSIS

An economic evaluation of alternatives produces information that can be used by decision-makers to determine the feasibility and/or the most desirable alternative. Breakeven analysis is one tool that can be used to conduct an economic evaluation.

WHAT IS BREAKEVEN ANALYSIS?

Breakeven analysis is a tool used to determine how much of an investment can be made based on the expected returns. Consider the following questions:

- How much money can I afford to spend?
- How long will it take to get my money back?
- What rate of return will I receive?
- How much net gain do I need to earn?

All four of these questions are "breakeven" questions. Each of the questions involves an unknown variable, i.e. cost, time, interest rate and change in yield (in terms of change in value or net return). You can solve for any variable if the other three variables are known.

TYPES OF BREAKEVEN ANALYSIS

TIME
Time breakeven analysis answers the question, "How long will it take to get my money back?" The answer to this question will tell you the minimum amount of time needed to recover your capital investment based on the other variables in the scenario. This type of breakeven can be used when the cost, interest rate and change in yield (net returns) are known.

PRICE (COST)
Price breakeven analysis answers the question, "How much money can I afford to spend?" The answer to this question will tell you the maximum amount you can pay for an alternative in order to breakeven based on the other variables in the scenario; any cost less than this value will result in a profit to the decision maker. This type of breakeven can be used when the time, interest rate and change in yield (net return) are known.

YIELD (VALUE)
Yield breakeven analysis answers the question, "How much net gain do I need?" The answer to this question will tell you the minimum amount that a unit of output needs to be worth to breakeven on the investment based on the other variables in the scenario. This type of breakeven can be used when the time, cost, and interest rate are known.

INTEREST RATE
Interest rate breakeven analysis answers the question, "What rate of return will I receive?" The answer to this question tells you the maximum interest rate that you can receive to breakeven based on the other variables of the scenario. This type of breakeven can be used when the time, cost, and change in yield (net returns) are known.

AMORTIZATION FACTORS

In order to complete a breakeven analysis problem, an amortization factor is required. The amortization factor is a value that takes into account time (the length of the period of analysis) and the interest rate received to determine the average annual payment amount (similar to calculating a car or home loan). Below is an Amortization Table which has calculated amortization factors for many common situations.

Life in Years	Amortization Table for Conservation Practices — Per Dollar of Installation Cost — Annual Interest Rate												
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%
1	1.010	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100	1.110	1.120	1.130
2	.508	.515	.523	.530	.538	.545	.553	.561	.568	.576	.584	.592	.599
3	.340	.347	.354	.360	.367	.374	.381	.388	.395	.402	.409	.416	.424
4	.256	.263	.269	.275	.282	.289	.295	.302	.309	.315	.322	.329	.336
5	.206	.212	.218	.225	.231	.237	.244	.250	.257	.264	.271	.277	.284
6	.173	.179	.185	.191	.197	.203	.210	.216	.223	.230	.236	.243	.250
7	.149	.155	.161	.167	.173	.179	.186	.192	.199	.205	.212	.219	.226
8	.131	.137	.142	.149	.155	.161	.167	.174	.181	.187	.194	.201	.208
9	.117	.123	.128	.134	.141	.147	.153	.160	.167	.174	.181	.188	.195
10	.106	.111	.117	.123	.130	.136	.142	.149	.156	.163	.170	.177	.184
11	.096	.102	.108	.114	.120	.127	.133	.140	.147	.154	.161	.168	.176
12	.089	.095	.100	.107	.113	.119	.126	.133	.140	.147	.154	.161	.169
13	.082	.088	.094	.100	.106	.113	.120	.127	.134	.141	.148	.156	.163
14	.077	.083	.089	.095	.101	.108	.114	.121	.128	.136	.143	.151	.159
15	.072	.078	.084	.090	.096	.103	.110	.117	.124	.131	.139	.147	.155
20	.055	.061	.067	.074	.080	.087	.094	.102	.110	.117	.126	.134	.142
25	.045	.051	.057	.064	.071	.078	.086	.094	.102	.110	.119	.127	.136
30	.039	.045	.051	.058	.065	.073	.081	.089	.097	.106	.115	.124	.133
50	.026	.032	.039	.047	.055	.063	.072	.082	.091	.101	.111	.120	.130
75	.019	.026	.034	.042	.051	.061	.070	.080	.090	.100	.110	.120	.130
100	.016	.023	.032	.041	.050	.060	.070	.080	.090	.100	.110	.120	.130

EXAMPLES OF BREAKEVEN ANALYSIS

The general equation to use when calculating any type of breakeven is:

Total Cost x Amortization Factor = Change in the Value of the Yield

Using algebra, you can solve for any of the four variables discussed previously.

TIME

How long will it take to recover the cost of an alternative costing $1,000, with an 8 percent interest rate, and the value of the increase in crop yield is $120?

> **SOLUTION:** Cost of Alternative x Amortization Factor = Value of the Change in Yield
> $1,000 x Amortization Factor = $120
> Amortization Factor = $120 / $1,000
> Amortization Factor = .12
>
> (To determine the number of years needed to breakeven, look in the Amortization Table in the 8% column until you find the factor closest to, but not less than, 0.12.)
>
> **Number of years needed to Breakeven on this investment = 14**

PRICE (COST)

How much can I afford to spend for a stock water development if the trough life is 20 years, the interest rate is 12 percent and the value of the increase in AUM's produced each year is $140?

> **SOLUTION:** Total Cost x Amortization Factor = Value of the Change in Yield
>
> (To find the appropriate amortization factor look in the Amortization table for the 12% interest rate and 20 years, this factor should be equal to 0.134.)
>
> Cost x 0.134 = $140
> Cost = $140 / 0.134
> Cost = $1,044.78
>
> **The maximum amount that you can spend and still breakeven is $1,044.78**

INTEREST RATE

What is the return on investment for an alternative that costs $1,000, over 20 years and the reduced machinery cost is $120 per year?

> **SOLUTION:** Total Cost x Amortization Factor = Value of the Change in Yield
> $1,000 x Amortization Factor = $120
> Amortization Factor = $120 / $1,000
> Amortization Factor = 0.12
>
> In the Amortization table, look across the 20 year row until you find the factor that is closest to, but not greater than, 0.12
>
> **The largest interest rate that you can receive and still breakeven in 11%**

YIELD (VALUE)

What must an AUM of grazing be worth to justify spending $1,400, over a 20 year period, with an interest rate of 11 percent and the average annual increase in AUM's at 20?

> **SOLUTION:** Total Cost x Amortization Factor = Value of the Change in Yield
>
> To find the appropriate amortization factor look in the Amortization table under the 11% interest rate and 20 years, this factor should be equal to 0.126.
>
> $1,400 x 0.126 = Value of 20 AUM's
> $176.40 = Value of 20 AUM's
> $176.40 / 20 = $8.82 per AUM
>
> **The minimum amount an AUM can be worth and still allow you to breakeven is $8.82**